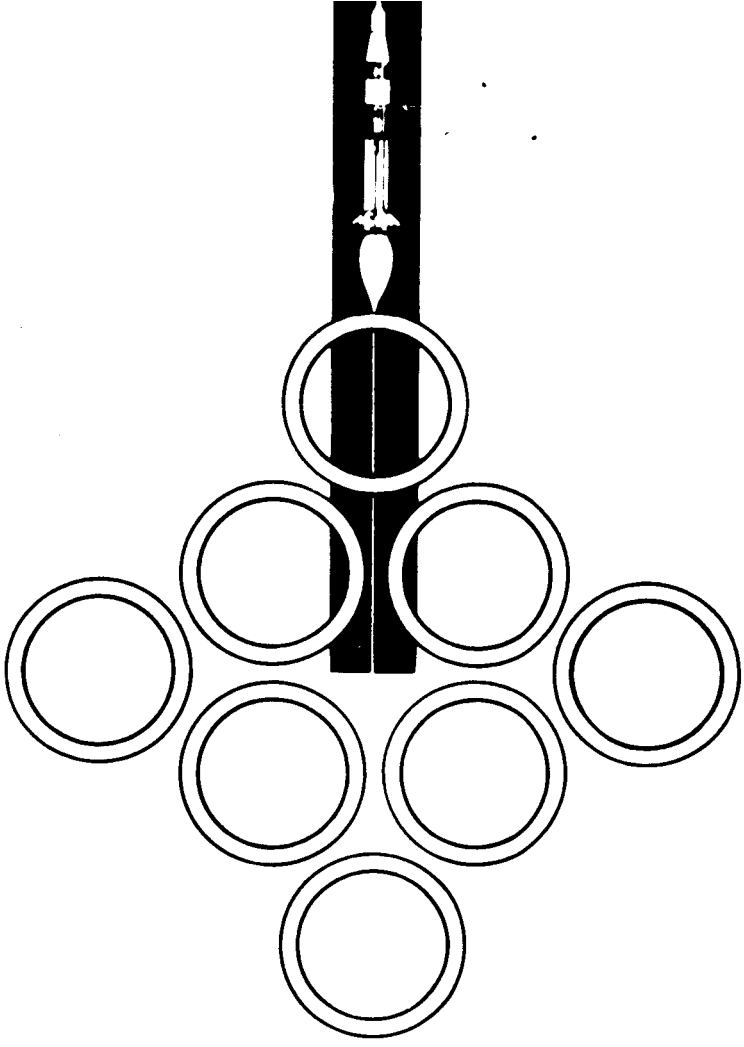


ENGINEERING DEPARTMENT

TECHNICAL REPORT

TR-RE-CCSD-FO-1101-5

April 26, 1967

SATURN IB PROGRAM

TEST REPORT
FOR

RELIEF VALVE, 1- BY 2-INCH, 950-PSIG

Anderson-Greenwood Co. Part Number 81S88-6 (Special)

NASA Drawing Number 75M12944 FRV-1

SPACE DIVISION CHRYSLER CORPORATION

TEST REPORT

FOR

RELIEF VALVE, 1- BY 2-INCH, 950-PSIG

Anderson-Greenwood Co. Part Number 81S88-6 (Special)

NASA Drawing Number 75M12944 FRV-1

ABSTRACT

This report presents the results of tests performed on three specimens of Relief Valve 75M12944 FRV-1. The following tests were performed:

1. Receiving Inspection
2. Proof Pressure
3. Functional

The test specimen did not meet the requirements of the Kennedy Space Center during the initial functional test. The cracking and reseat pressures were not within the specified tolerances and severe leakage occurred at the valve seat. Testing was discontinued after the initial functional test.

TEST REPORT

FOR

RELIEF VALVE, 1- BY 2-INCH, 950-PSIG

Anderson-Greenwood Co. Part Number 81S88-6 (Special)

NASA Drawing Number 75M12944 FRV-1

April 26, 1967

CHRYSLER CORPORATION SPACE DIVISION - NEW ORLEANS, LOUISIANA

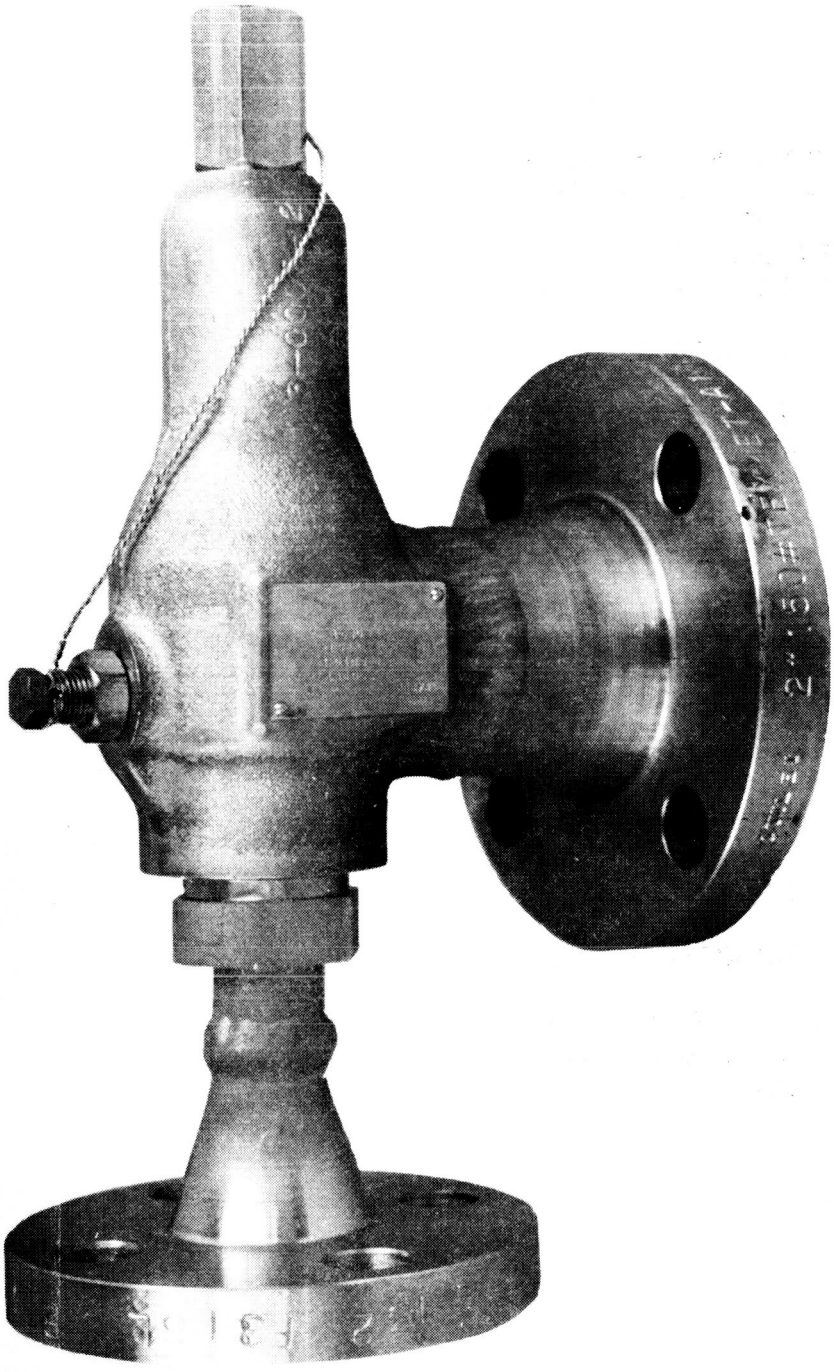
FOREWORD

The tests reported herein were conducted for the John F. Kennedy Space Center by Chrysler Corporation Space Division (CCSD), New Orleans, Louisiana. This document was prepared by CCSD under contract NAS 8-4016, Part VII, CWO 271620.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES



Relief Valve, 1-by 2-Inch, 950 psig

75M12944 FRV-1

CHECK SHEET

FOR

RELIEF VALVE, 1- BY 2-INCH, 950-PSIG

MANUFACTURER: Anderson-Greenwood Co.
MANUFACTURER'S PART NUMBER: 81S88-6 (Special)
NASA DRAWING NUMBER: 75M12944 FRV-1
TESTING AGENCY: Chrysler Corporation Space Division, New Orleans, Louisiana
AUTHORIZING AGENCY: NASA KSC

I. FUNCTIONAL REQUIREMENTS

A.	OPERATING MEDIUM:	Liquid nitrogen, gaseous nitrogen
B.	CRACKING PRESSURE:	1050 psig
C.	LEAKAGE:	10 bubbles per minute
D.	PROOF PRESSURE:	1575 psig

II. CONSTRUCTION

A.	BODY MATERIAL:	316 stainless steel
B.	SEAT MATERIAL:	Teflon
C.	CONNECTIONS:	
	1. Inlet	600 pound ASA flange
	2. Outlet	150 pound ASA flange

III. ENVIRONMENTAL REQUIREMENTS

A.	HIGH TEMPERATURE:	125°F

IV. LOCATION AND USE

The relief valve is used to provide overpressurization protection for the LOX and GOX drain line in the space-craft support system on Launch Complex 34.

TEST SUMMARY

RELIEF VALVE, 75M12944 FRV-1

Environment	Operational Boundary	Test Objective	Test Results	Remarks
Receiving Inspection	Compliance with vendor and NASA drawings	Determine if specimen complies with drawings and check for defects and poor workmanship.	Satisfactory	None
Proof Pressure	Inlet Pressure: 1575 psig Outlet Pressure: 400 psig	Verify that the test specimen would withstand test pressures without leakage or distortion.	Satisfactory	None
Functional	Allowable Leakage: 10 bubbles/min Cracking Pressure: 1050 psig min, 1175 psig max Reseat Pressure: 893 psig min	Determine if test specimen would operate satisfactorily prior to environmental exposure.	Unsatisfactory	Unsatisfactory cracking and reseating pressures. Severe leakage of valve seat. Testing was discontinued.
Flow	Inlet Pressure: 1155 psig	Determine flow rate through test specimen at 110 per cent cracking pressure.	---	Test not performed
High Temperature	Temperature: 125 (+4, -0)°F	Determine if test specimen would operate satisfactorily during high temperature conditions.	---	Test not performed
Icing	Temperature: 5°F	Determine if test specimen would operate satisfactorily during icing conditions.	---	Test not performed
Sand and Dust	Two hours sand and dust conditions	Determine if test specimen would operate satisfactorily after exposure to sand and dust conditions.	---	Test not performed
Cycle	500 cracking cycles	Determine if test specimen would operate satisfactorily after being subjected to 500 cracking cycles.	---	Test not performed
Burst	Burst Pressure: 4200 psig	Determine if test specimen would withstand 4200 psig without rupture or distortion.	---	Test not performed

SECTION I

INTRODUCTION

1.1 SCOPE

This report presents the results of tests that were performed to determine if Relief Valve 75M12944 FRV-1 meets the operational requirements for John F. Kennedy Space Center. A summary of the test results is presented on page vii.

1.2 ITEM DESCRIPTION

1.2.1 The relief valve is used to provide overpressurization protection for the LOX and GOX drain line in the spacecraft support system on Launch Complex 34. The vendor is Anderson-Greenwood Co. The valve connections are a 1-inch, 600-pound ASA, raised-face flange inlet, and a 2-inch, 150-pound ASA, raised-face flange outlet.

1.3 APPLICABLE DOCUMENTS

1.3.1 The following documents contain the test requirements for relief valve 75M12944 FRV-1.

a. KSC-STD-164(D), Standard Environmental Test Methods for Ground Support Equipment Installations at Cape Kennedy

b. Drawing 75M12944 LRV-1, Valve, Relief

c. Cleanliness Standard, MSFC-STD-164

d. Test Plan CCSD-FO-1101-1F

e. Test Procedure TP-RE-CCSD-FO-1101-2F

SECTION II

RECEIVING INSPECTION

2.1 TEST REQUIREMENTS

The test specimen shall be visually and dimensionally inspected for conformance to applicable specifications prior to testing.

2.2 TEST PROCEDURE

Each test specimen was inspected for compliance with NASA drawing 75M12944 FRV-1 and the applicable vendor drawing to the extent possible without disassembly of the test specimen. Each specimen was also inspected for poor workmanship and manufacturing defects.

2.3 TEST RESULTS

The test specimen was in compliance with NASA drawing 75M12944 FRV-1 and the applicable vendor drawing. There was no evidence of poor workmanship or manufacturing defects.

2.4 TEST DATA

Receiving inspection data are presented in table 2-1.

Table 2-1. Receiving Inspection Data

Part Number	81S88-6
Serial Number	26678
Inlet Connection	600-pound ASA flange
Outlet Connection	150-pound ASA flange

SECTION III

PROOF PRESSURE TEST

3.1 TEST REQUIREMENTS

3.1.1 The test specimen inlet shall be subjected to a pressure of 1575 psig GN_2 for five minutes.

3.1.2 The test specimen outlet shall be subjected to a pressure of 400 psig GN_2 for five minutes.

3.1.3 The test specimen shall be examined for distortion.

3.2 TEST PROCEDURE

3.2.1 The specimen was installed as shown in figures 3-1 (view A) and 3-2 using the equipment listed in table 3-1.

3.2.2 Hand valve 4 was opened and regulator 7 was adjusted to slowly pressurize the specimen to 1575 psig as indicated on gage 9. This pressure was maintained for five minutes.

3.2.3 Hand valve 4 was closed and the pressure on the specimen was vented.

3.2.4 The specimen was installed as shown in figure 3-1 (view B).

3.2.5 Hand valve 4 was opened and regulator 7 was adjusted to slowly pressurize the test specimen to 400 psig. This pressure was maintained for five minutes.

3.2.6 Hand valve 4 was closed and the test specimen was vented.

3.2.7 The test specimen was removed from the setup and was examined for distortion.

3.3 TEST RESULTS

3.3.1 The test specimen inlet was subjected to 1575 psig GN_2 for five minutes.

3.3.2 The test specimen outlet was subjected to 400 psig GN_2 for five minutes.

3.2.3 No distortion of the test specimen occurred.

3.4 TEST DATA

Proof pressure test data are presented in table 3-2.

Table 3-1. Proof Pressure Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Anderson-Greenwood Co.	81S88-6 (Special)	26678	
2	GN_2 Source				3500-psig
3	Pressure Gage	Ashcroft	NA	B.T. 200617-F	0 to 5000-psi 0.5%FS Cal date 3-27-67
4	Hand Valve	Robbins	NA	NA	
5	Filter	Bendix	1730150	60	
6	Pressure Gage	Ashcroft	NA	200617-K	0 to 5000-psi 0.5% FS Cal date 3-27-67
7	Pressure Regulator	Tescom	26-1003	1003	
8	Pressure Regulator	Grove	WH-408-N3	R67028	
9	Pressure Gage	Heise	NA	200617-D	0 to 3500-psi 0.1% FS Cal date 3-27-67

Table 3-2. Proof Pressure Test Data

Pressure (psig)	Distortion
Inlet: 1575	None
Outlet: 400	None

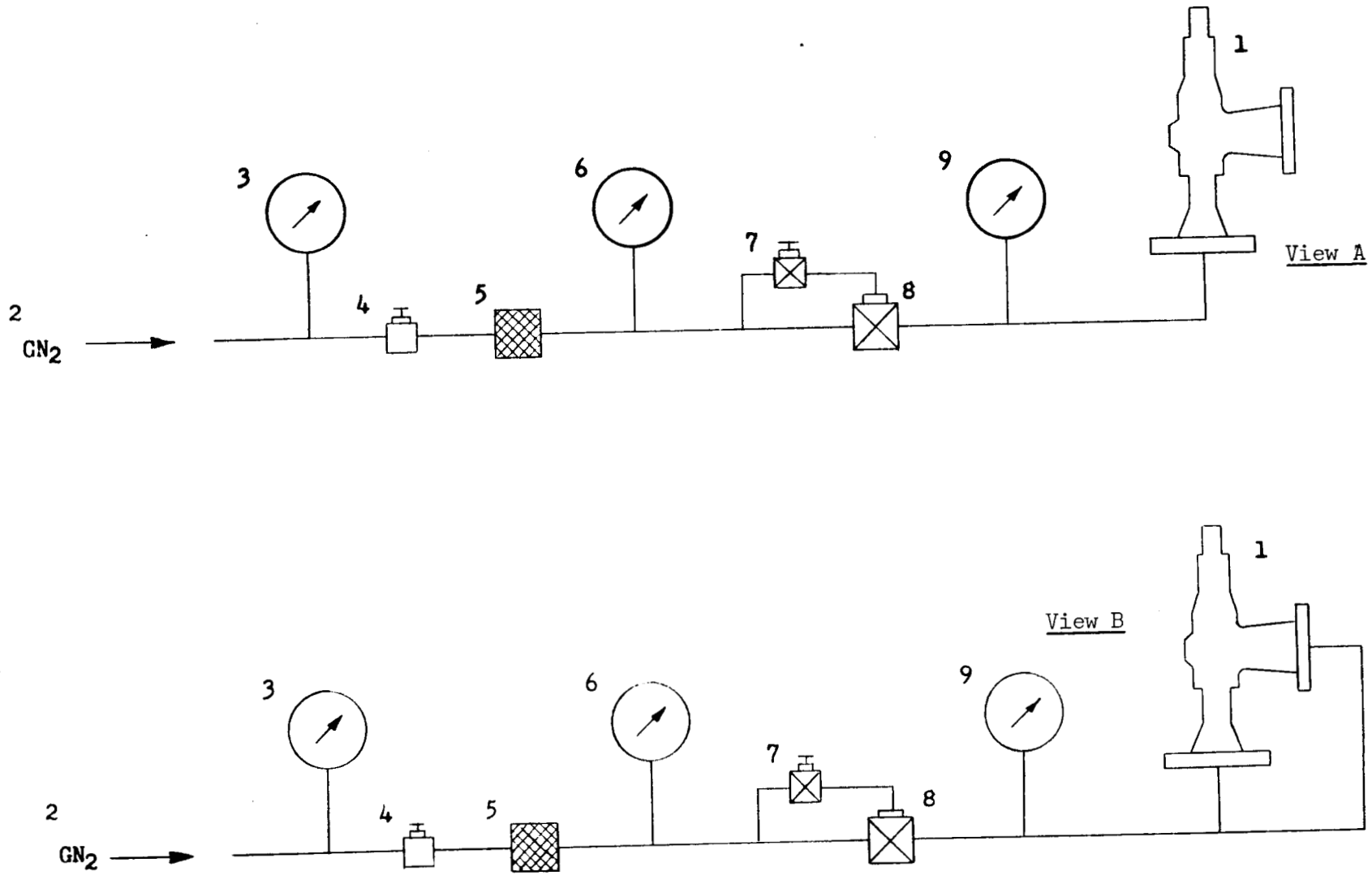


Figure 3-1. Proof Pressure Test Schematic

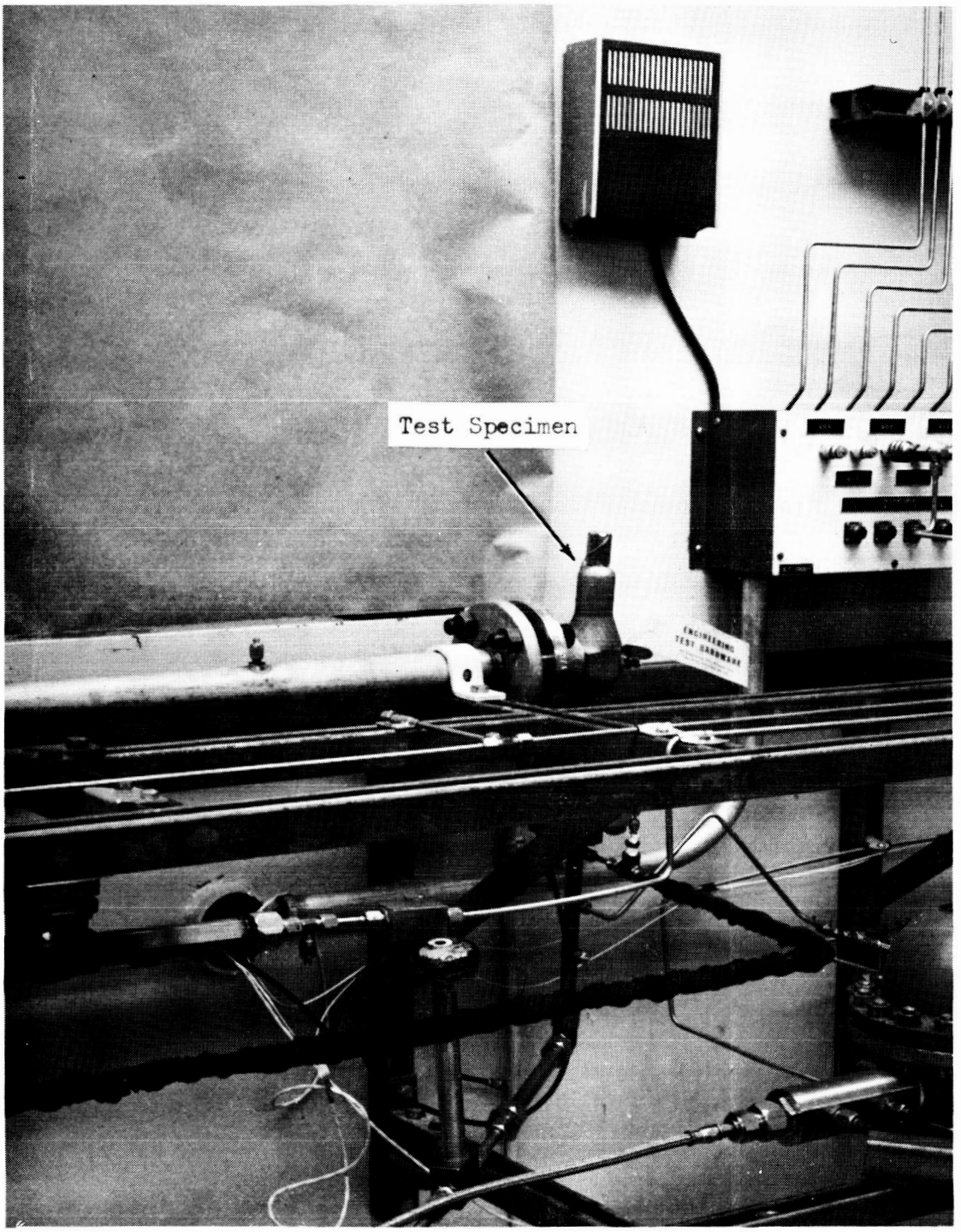


Figure 3-2. Proof Pressure Test Setup

SECTION IV

FUNCTIONAL TEST

4.1 TEST REQUIREMENTS

4.1.1 The test specimen shall be inspected for internal leakage at 950 psig for 5 minutes. The maximum allowable leakage shall be 10 bubbles per minute.

4.1.2 The cracking and reseating pressures of the test specimen shall be determined using GN_2 at -320°F as the test medium.

4.2 TEST PROCEDURE

4.2.1 The specimen was installed as shown in figures 4-1 and 4-2 using the test equipment listed in table 4-1 except LN_2 was not placed in heat exchanger 10.

4.2.2 Hand valves 9 and 11 were opened and hand valve 15 was closed. Regulator 7 was adjusted to slowly pressurize the specimen inlet to 950 psig as indicated on gage 8.

4.2.3 This pressure was maintained for five minutes and the specimen was checked for internal leakage by monitoring water container 16.

4.2.4 The specimen was vented by closing hand valves 9 and 11 and opening hand valve 15.

4.2.5 Heat exchanger 10 was filled with LN_2 and water reservoir 16 was removed.

4.2.6 Hand valve 15 was closed and hand valves 9 and 11 were opened.

4.2.7 Regulator 7 was adjusted to pressurize the specimen inlet to 950 psig as indicated on gage 12.

4.2.8 Hand valve 15 was cracked to allow GN_2 to flow through the system.

4.2.9 When temperature gage 14 indicated the presence of GN_2 at -320°F hand valve 15 was closed.

4.2.10 Specimen inlet pressure was increased by adjusting regulator 7 until cracking occurred. Cracking pressure was recorded.

4.2.11 The specimen inlet pressure was decreased by adjusting regulator 7 until reseating occurred. Reseat pressure was recorded.

4.2.12 The procedure described in paragraphs 4.2.10 and 4.2.11 was performed as many times as necessary to obtain consistent data.

4.2.13 The specimen was vented by closing regulator 7.

4.3 TEST RESULTS

4.3.1 The specimen inlet was slowly pressurized with GN_2 at room ambient temperature to 950 psig. This pressure was maintained for five minutes and the test specimen was checked for internal leakage. No leakage occurred.

4.3.2 The specimen was pressurized with GN_2 at -320°F. This pressure was slowly increased until cracking occurred. The pressure at which the specimen cracked was below the specified cracking pressure of 1050 psig.

4.3.3 The specimen inlet pressure was decreased until reseating occurred. Reseating occurred but with severe leakage.

4.3.4 As a result of low temperature GN_2 flowing through the specimen while cracked, the temperature of the specimen was lowered. Under these low temperature conditions severe leakage occurred at the valve seat.

4.3.5 The specimen was disassembled and inspected for damage. The disassembled specimen is shown in figure 4-3. The valve seat was slightly scored as shown in figure 4-4. No other damage was apparent.

4.3.6 The specimen was reassembled and adjusted and a second functional test was performed. The results of the second functional test were the same as those of the first.

4.3.7 Testing was suspended and the specimen was returned to the vendor for repairs. The vendor returned the repaired specimen and testing was continued.

4.3.8 The specimen was slowly pressurized with GN_2 at room ambient temperature to 950 psig. This pressure was maintained for five minutes and the specimen was checked for internal leakage. No leakage occurred.

4.3.9 The specimen was pressurized with GN_2 at -320°F. The pressure was slowly increased until cracking occurred. The pressure at which the test specimen cracked was below the specified cracking pressure of 1050 psig.

4.3.10 The test specimen inlet pressure was decreased until reseating occurred. Reseating pressure was below the specified minimum of 893 psig. The blowdown adjustment was reset in an attempt to raise the reseat pressure. However, this could not be accomplished because the blowdown adjustment was pre-set for maximum reseat pressure.

4.3.11 As the temperature of the test specimen was lowered by the flow of low temperature GN_2, severe internal leakage occurred.

4.3.12 Testing was discontinued at this point.

4.4 TEST DATA

Functional test data are presented in tables 4-2, 4-3, and 4-4.

Table 4-1. Functional Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Anderson-Greenwood Co.	81S88-6 (Special)	26678	
2	GN_2 Source				3500-psig
3	Pressure Gage	Ashcroft	1850	NA	0 to 5000-psi ±0.5% FS Cal date 1-20-67
4	Hand Valve	Combination Pump Co.	NA	NA	1/2-inch
5	Filter	Microporous Media Inc.	4813F-2DM	NA	
6	Pressure Gage	Ashcroft	NA	NA	0 to 5000-psi ±0.5% FS Cal date 1-20-67
7	Pressure Regulator	Grove	WH-408-N4	RA-5223	
8	Pressure Gage	Heise	H-35832	200595	0 to 3500-psi ±0.1% FS Cal date 1-20-67
9	Hand Valve	Robbins	NA	NA	1/4-inch
10	Heat Exchanger	CCSD	NA	NA	
11	Hand Valve	Control Components	ES 608-TP	NA	1/2-inch
12	Pressure Gage	Heise	H-35836	200595-W	0 to 3000-psi ±0.1% FS Cal date 1-20-67
13	Accumulator	CCSD	NA	NA	5-gallon
14	Temperature Gage	West Instrument Co.	NA	BTN 95-1513-B	±20% accuracy Cal date 10-31-66

Table 4-1. Functional Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
15	Hand Valve	Control Components	ES 6004 -PP	NA	1/4-inch
16	Water Container		NA	NA	

Table 4-2. Initial Functional Test Data

Leakage at Room Temperature	None

Cracking Pressure (psig)	Reseat Pressure (psig)
1035	875
1015	970
1010	1005

Leakage After Chill Down	Severe

Table 4-3. Functional Test Data Following Disassembly and Inspection

Leakage at Room Temperature	None

Cracking Pressure (psig)	Reseat Pressure (psig)
1065	975
1025	980
1030	985
1030	985

Leakage After Chill Down	Severe

Table 4-4. Functional Test Data Following Vendor Repairs

Leakage at Room Temperature	None

Cracking Pressure (psig)	Reseat Pressure (psig)
1075	400
900	500
700	500
900	500

Leakage After Chill Down	Severe

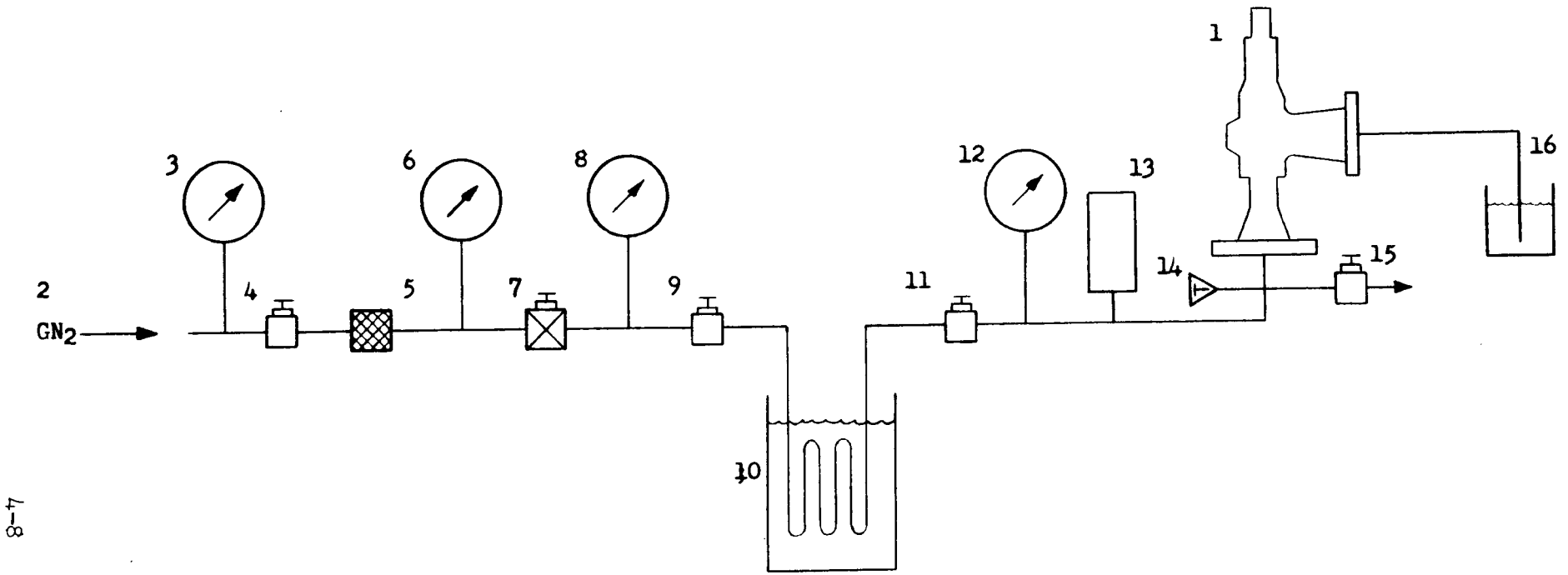


Figure 4-1. Functional Test Schematic

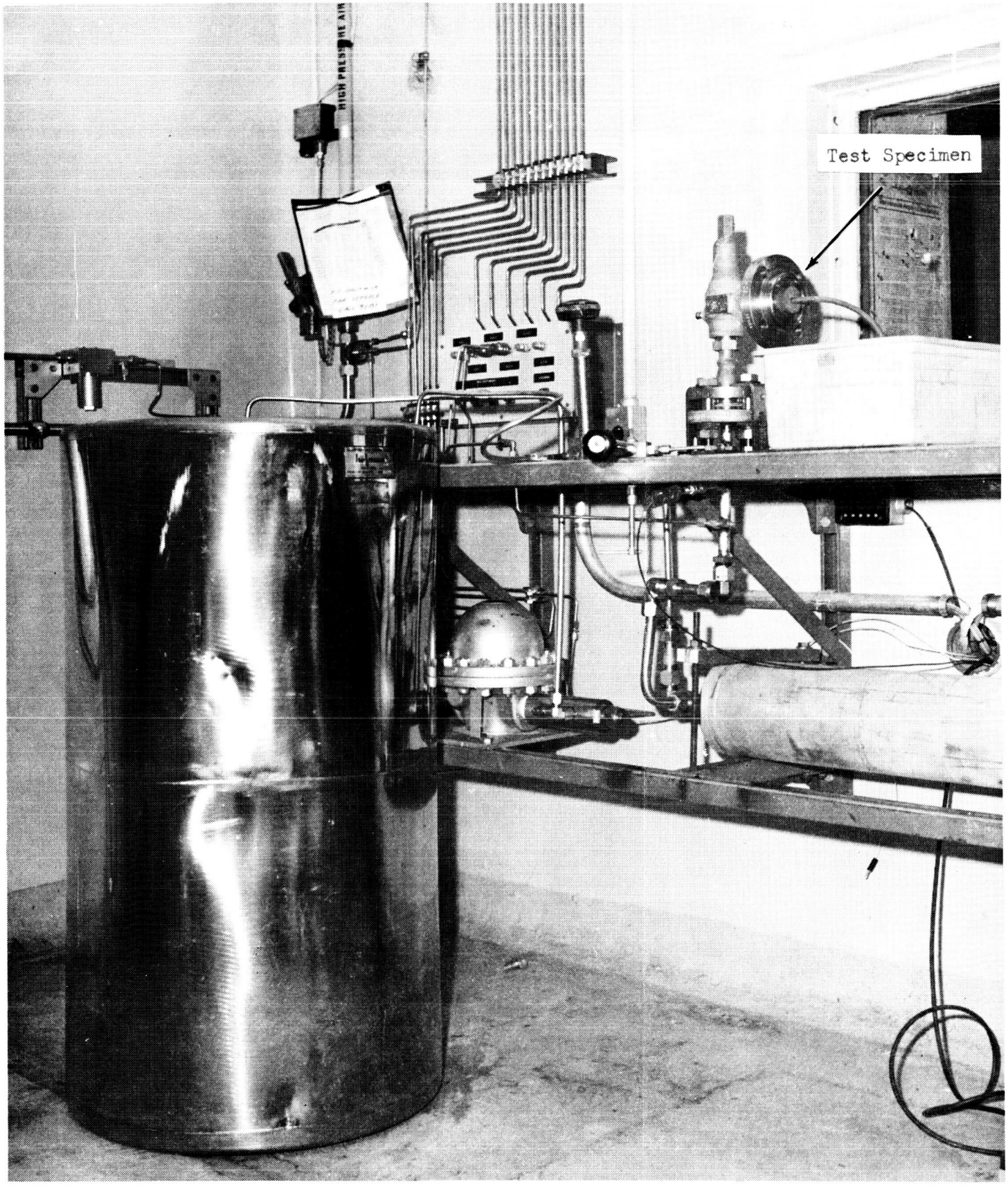


Figure 4-2. Functional Test Setup

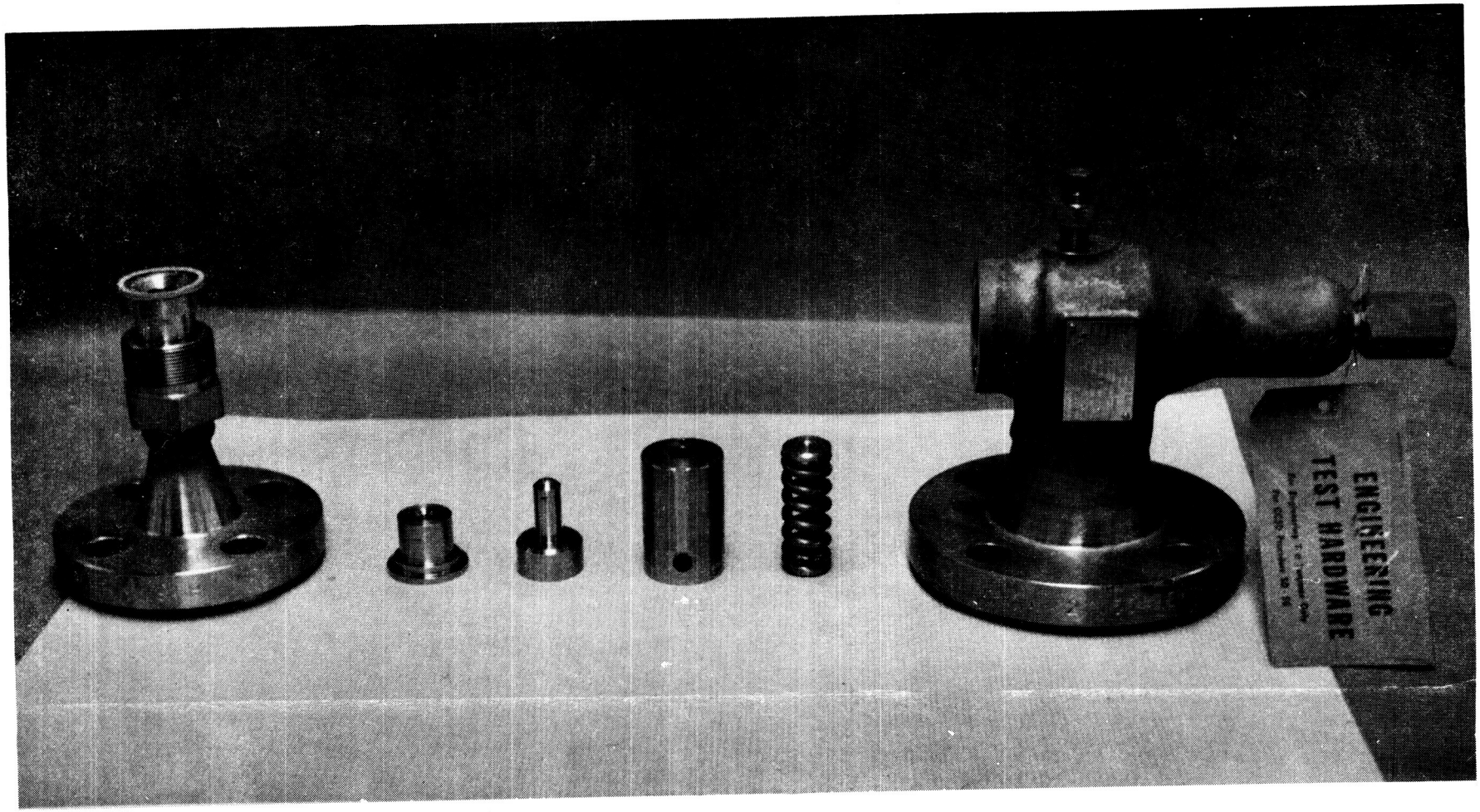


Figure 4-3. Disassembled Test Specimen

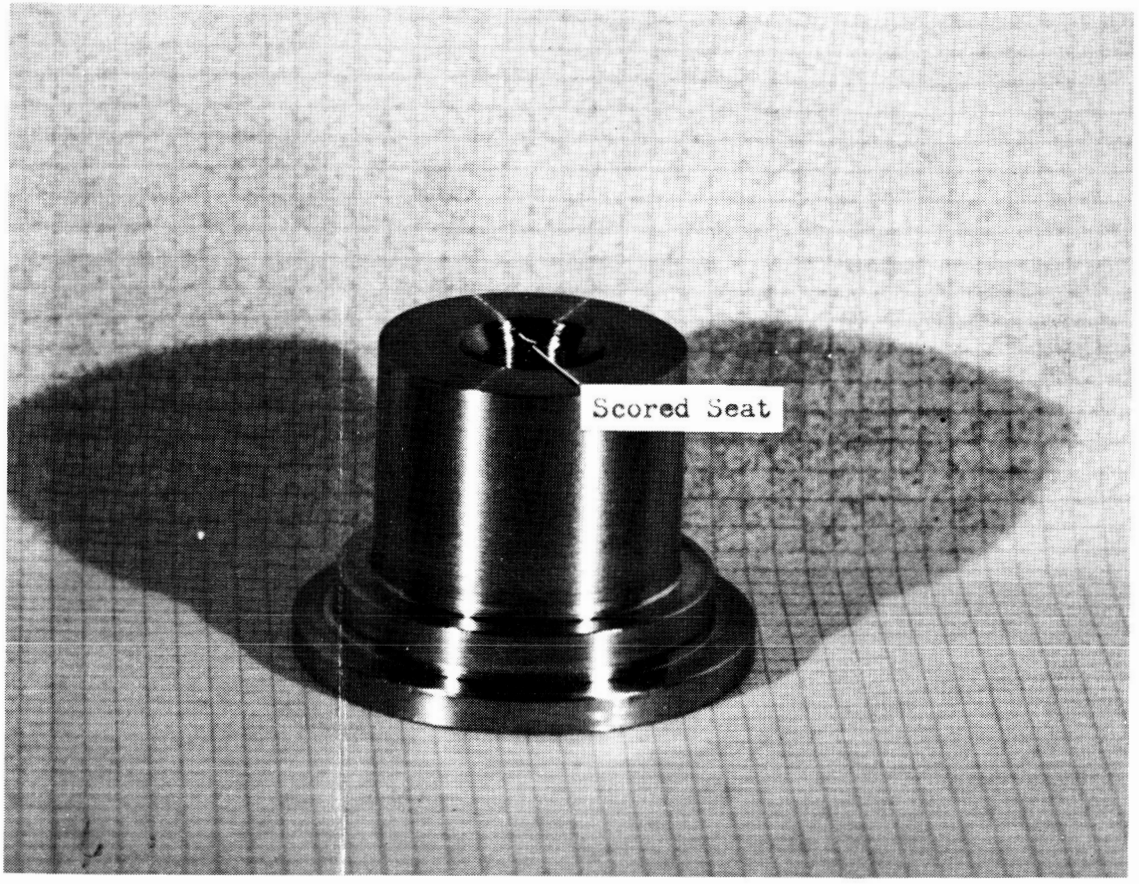


Figure 4-4. Scored Valve Seat

APPROVAL

TEST REPORT

FOR

RELIEF VALVE, 1- BY 2-INCH, 950-PSIG

Anderson-Greenwood Co. Part Number 81S88-6 (Special)

NASA Drawing Number 75M12944 FRV-1

SUBMITTED BY:

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